

**REGULATORY APPROACHES  
TO REDUCE PARTICULATE MATTER EMISSIONS FROM  
TRANSPORT REFRIGERATION UNITS**



**June 5, 2003**



**California Environmental Protection Agency**  
**Air Resources Board**

## **Overview**

- Update on TRU emissions inventory
- TRU ATCM Action to-date
- Summary of last TRU ATCM proposal
- New TRU ATCM proposal
- Regulatory development schedule
- Contacts

# Update TRU Emissions Inventory

3

## TRU Emission Inventory

Revisions to the Diesel Transport  
Refrigeration Unit (TRU)  
Emissions Inventory

June 2003

4

## TRU Emission Inventory

Transport refrigeration units (TRU) are diesel powered cooling units that are installed on vehicles used in transporting produce, meat, dairy products, and other perishable goods. They are found on refrigerated vans, trucks, trailers, and railroad cars.

5

## TRU Emission Inventory

The inventory in tons per day is calculated using the following equation:

$$\text{Inventory} = \frac{\text{Emission Rate} * \text{Population} * \text{Activity} * \text{Average Horsepower} * \text{Load Factor}}{2000}$$

Emission rate by pollutant in gms/hp-hr

Activity is in hrs/year or hrs/day of engine run time

Average horsepower is the average maximum rated horsepower within each horsepower group.

Load Factor is the average operation level in a given application and is expressed as a percent of the engine manufacturer's maximum horsepower ratings.

6

# TRU Emission Inventory

## Reasons for Revisions:

- More up to date population and activity estimates were obtained from TRU Manufacturers.

7

## Revisions are proposed for:

Useful life  
Survival rates  
Population  
Average Horsepower  
Load Factor  
Activity

8

## Statewide TRU Tons Per Day 2000

	PM (tpd) Proposed	NOx (tpd) Proposed
<15 hp	0.10	1.37
15-25 hp	0.07	0.79
25-50 hp Ca	1.94	13.66
25-50 hp Out of State	0.64	4.51
25-50 hp Rail	0.13	0.92
>50 hp	NA	NA
TOTALS	2.88	21.25

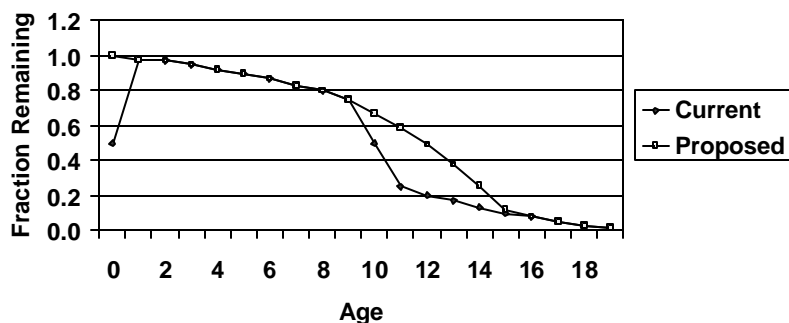
9

## Useful life

- Is defined as the age after which 50% of originally sold equipment population still exists, however, the remaining engines could last twice as long.
- Revised from 16 years (Oldest TRU 32 years) to 10 years (Oldest TRU 20 years)

10

## Survival rate from original sales



11

## TRU Sales

- National Sales Data by hp group was provided by Manufacturers for 1991-2000
- Curve fit was used to estimate sales for the remaining ten years (1990-1981)
- U.S. Census Commodity Flow Survey showed 6.4% of truck ton-mile share for CA
- Survival rate applied to CA sales to obtain 2000 population of TRU installed on CA registered vehicles

12

## Out of State TRU

- Per EMFAC 2002, 25% of the total, or 33% or California-only HHDD truck population that travels on California roads is registered outside of California
- Using the same basis, additional out of state TRU population in 25-50 hp group operating in California was estimated.

13

## Railcars TRU

- Staff used the American Association of Railroads information.
- TRU on railcars are in 25-50 hp group
- Commodity Flow Survey data indicated 19 % of the entire U.S. rail ton-miles for refrigerated goods are in CA

14

## Out of state, railcars TRU

- Activity, age distribution and load factor are the same as for TRUs installed on California vehicles.

15

## Population - CY 2000

	Population Existing	Population Proposed
<15 hp	0	7682
15-25 hp	1517	3497
25-50 hp Ca	8412	24925
25-50 hp Out of State	0	8225
25-50 hp Rail	0	1678
>50 hp	30902	0
TOTALS	40831	46007

16

## TRU Input Factors

hp groups	<15 hp	15-25 hp	25-50 hp	> 50 hp
<b>Average hp</b>				
Existing	NA	17	39	56
Proposed	10	17	34	NA
<b>Activity (hrs/yr)</b>				
Existing	NA	750	1341	1341
Proposed	1038	1038	1465	NA
<b>Load Factor</b>				
Existing	NA	0.50	0.28	0.28
Proposed	0.64	0.64	0.53	NA
<b>Population</b>				
Existing	0	1517	8412	30902
Proposed	7682	3497	34828	NA

17

## TRU Input Factors

hp groups	<15 hp	15-25 hp	25-50 hp	> 50 hp
<b>Useful life</b>				
Existing	NA	6	16	16
Proposed	10	10	10	NA
<b>Average Nox gms/hp-hr</b>				
Existing	NA	6.82	7.53	11.61
Proposed	8.93	6.62	6.88	NA
<b>Average PM gms/hp-hr</b>				
Existing	NA	0.60	1.15	1.10
Proposed	0.64	0.56	0.98	NA

18

# TRU ATCM

## Action To-Date

19

- 4th TRU Workshop
- 8 TRU Workgroup meetings
- Four Special TRU Electrification Workgroup meetings
- Established Control Technology Matrix
- Provided draft TRU regulation language
- Completed information gathering
  - ◆ TRU and TRU generator set manufacturers
  - ◆ TRU engine manufacturers
  - ◆ Emission control system manufacturers
- Completed 24 facility visits

20

- Collected preliminary cost data for alternative technologies
- Gathered information on gen sets
- Learned about intermodal facilities
- Learned about leasing operations
- Evaluated special TRU test-cycle
- Working on diesel PM filter demos
- Data logging TRU engines
- Investigating Ag TRU operations
- Working with facility databases
- Working with fleet databases

21

## Summary Last TRU ATCM Proposal

- New Engine Standards
- In-Use TRUs - Operator reqmts
  - ✦ Retrofit in-use TRUs and gen sets with verified diesel emission control strategy - highest classification level verified
  - ✦ Employ "Alternative Technologies"
  - ✦ Replace old engine with new certified engine
- Facility requirements
  - ✦ Look at options to reduce near-source risk

22

# New TRU ATCM Proposal

23

## June 5th TRU ATCM Concept Overview

- New engine standards - Harmonize with U.S. EPA - ARB to adopt tier 4 in 2004
- In-Use TRUs - Operator requirements:
  - ◆ Establish in-use performance standards
  - ◆ Phase in performance standards in tune with proposed offroad new engine standards
- Facility requirements
  - ◆ Recordkeeping and reporting for facilities with control over TRUs and TRU gen sets

24

## In-Use Applicability

- Applies to all TRUs and TRU gen sets operated in California & used with
  - ◆ Trucks and trailers
  - ◆ Refrigerated railcars
  - ◆ Refrigerated shipping containers
- Exemption - “low use” TRUs and TRU gen sets
  - ◆ Infrequent out-of-state carriers (<10 loads/year)
  - ◆ Seasonal (<80 hours/year)

25

## Requirements In-Use TRUs & TRU Gen Sets

- In-use performance standards would established for
  - ◆ <25 hp TRU and TRU gen sets
  - ◆  $\geq$ 25 hp TRU and TRU gen sets

26

## In-Use TRUs & TRU Gen Sets (cont'd)

- <25 hp TRU and TRU gen set PM performance standards

In-Use Emission Category	Engine Certification (g/hp-hr)	Level of VDECS Equipped with
Low Emission TRU (LETRU or L)	0.30	Level 1
Ultra-Low Emission TRU (ULETRU or U)	TBD	Level 2 or better

- Technology reviews in 2007 and 2009 to evaluate availability and cost-effectiveness of Level 3 VDECS and alternative technologies for ULETRU

27

## In-Use TRUs & TRU Gen Sets (cont'd)

- $\geq 25$  hp TRU and TRU gen set PM performance standards

In-Use Emission Category	Engine Certification (g/hp-hr)	Level of VDECS Equipped with
Low Emission TRU (LETRU or L)	0.22	Level 1 or 2
Ultra-Low Emission TRU (ULETRU or U)	0.02	Level 3

- Ultra-low emission TRU (ULETRU) also means a TRU using one of the “alternative technologies”

28

## In-Use TRUs & TRU Gen Sets (cont'd)

- Operators can choose from a variety of compliance options to meet in-use performance standards
  - ◆ Replacing old engines with new, certified engines
  - ◆ Retrofitting existing engines with a verified diesel emission control strategy (VDECS)
  - ◆ Using one of the “alternative technologies”

29

## New Engine Standards (reference)

- Harmonize with U.S. EPA's *Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel*
  - ◆ Notice of Proposed Rulemaking out on April 15, 2003
  - ◆ PM and NMHC+NO<sub>x</sub> standards (g/hp-hr)

HP Category	Compliance Year						
	2008	2009	2010	2011	2012	2013	2014
<25 hp	0.30 PM						
≥25 to <75 hp	0.22 PM					0.02 PM 3.5 NMHC+NO <sub>x</sub>	

30

## In-Use TRUs & TRU Gen Sets (cont'd)

- Verification classification levels for Verified Diesel Emission Control Strategies (VDECS)
  - ◆ Level 1 -  $\geq 25\%$  reduction
  - ◆ Level 2 -  $\geq 50\%$  reduction
  - ◆ Level 3 -  $\geq 85\%$  reduction or 0.01 g/bhp-hr

31

## In-Use TRUs & TRU Gen Sets (cont'd)

- Alternative technologies:
  - ◆ Electric standby,
  - ◆ Cryogenic temperature control (or hybrid),
  - ◆ Alternative-fueled engines,
  - ◆ Alternative-diesel-fueled engines,
  - ◆ Fuel cells, or
  - ◆ Any other system approved by EO not to emit diesel PM while at affected facility.

32

## In-Use TRUs & TRU Gen Sets (cont'd)

### ■ Compliance Dates (general)

- ◆ 2001 and previous model years
  - ✦ Meet LETRU by December 31, 2008
  - ✦ Meet ULETRU by December 31, 2015
- ◆ 2002 and subsequent model years
  - ✦ Meet LETRU 7 years after model year
    - 2002 - by December 31, 2009
  - ✦ Meet ULETRU 7 years later
    - 2002 - December 31, 2016

33

## In-Use TRUs & TRU Gen Sets (cont'd)

### ■ Compliance dates for <25 hp

MY	In-Use Compliance Year													
	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20
'01 & Prev		L	L	L	L	L	L	L	U	U	U	U	U	U
'02			L	L	L	L	L	L	U	U	U	U	U	U
'03				L/U	L/U	L/U	U	U	U	U	U	U	U	U
'04					L/U	L/U	U	U	U	U	U	U	U	U
'05						L/U	U	U	U	U	U	U	U	U
'06							U	U	U	U	U	U	U	U

- Once a unit qualifies as ULETRU, then no further emission reductions are necessary for that unit

34

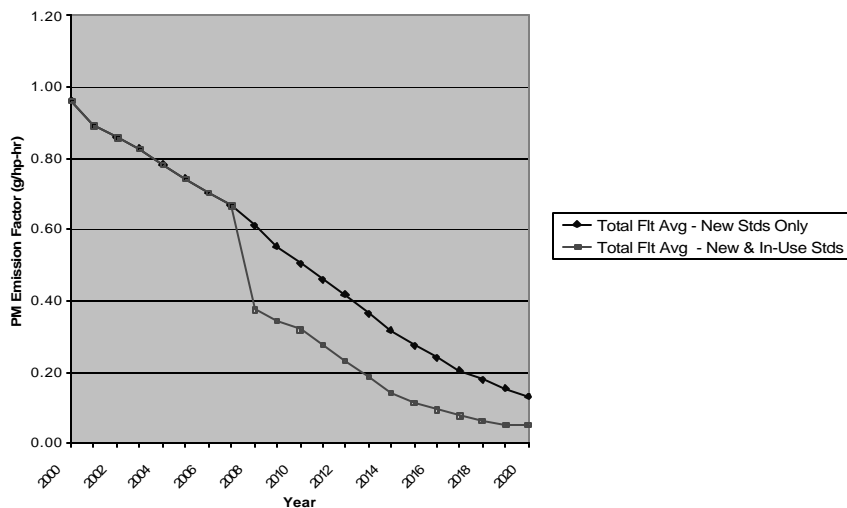
# In-Use TRUs & TRU Gen Sets (cont'd)

## ■ Compliance dates for $\geq 25$ hp

	In-Use Compliance Year													
M Y	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20
'01 & Prev		L	L	L	L	L	L	L	U	U	U	U	U	U
'02			L	L	L	L	L	L	L	U	U	U	U	U
'03				L/U	L/U	L/U	U	U	U	U	U	U	U	U
'04					L/U	L/U	U	U	U	U	U	U	U	U
'05						L/U	U	U	U	U	U	U	U	U
'06							U	U	U	U	U	U	U	U
'07								U	U	U	U	U	U	U
'08									U	U	U	U	U	U
'09										U	U	U	U	U
'10											U	U	U	U
'11												U	U	U
'12													U	U
'13														

35

Statewide Total Fleet Average Emission Factor for TRUs



36

## In-Use TRUs & TRU Gen Sets (cont'd)

### ■ Labeling

- ◆ Quick & easy means of identifying
  - ✦ Equipment that is in compliance with retrofit/replace/alternative technology requirements
  - ✦ “Low Use” TRUs and gen sets
- ◆ Visual indication, bar code, or other technology

37

## In-Use TRUs & TRU Gen Sets (cont'd)

### ■ Early Compliance with In-Use LETRU

- ◆ One to 3 years early LETRU compliance results in 1 to 3 years delay in ULETRU deadline
- ◆ No more than 3 years delay allowed
- ◆ DNA to <25 hp if tier 4 PM standards remain at 0.30 g/hp-hr beyond 2013
- ◆ ARB certificate and label issued to I.D. specific TRU and number of years delay

38

## In-Use TRUs & TRU Gen Sets (cont'd)

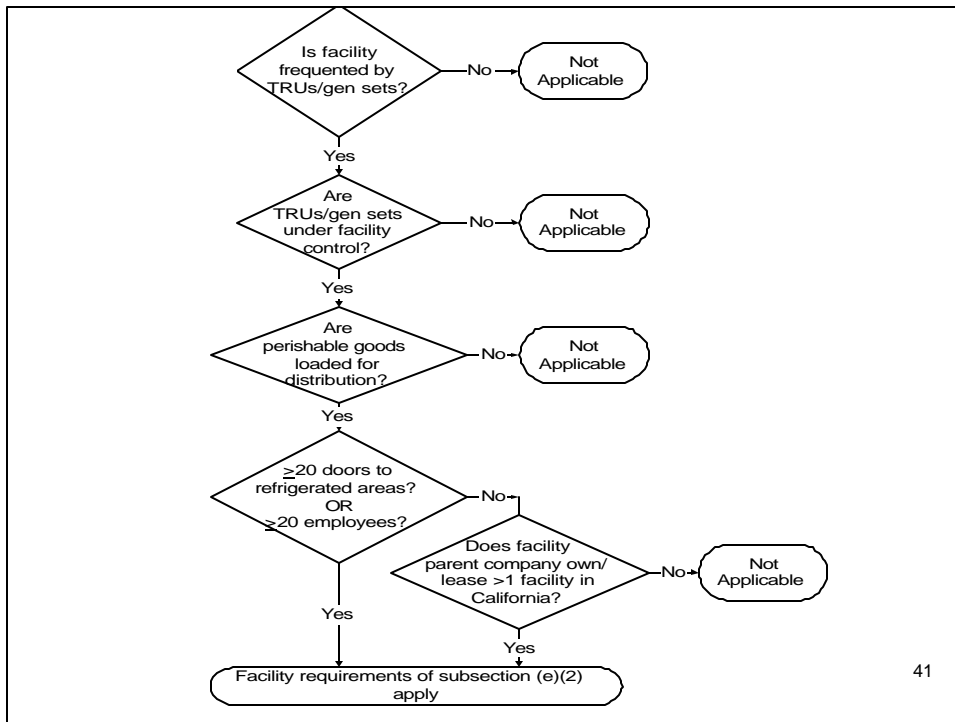
- Annual recordkeeping and reporting
  - ◆ Starting in 2009
  - ◆ All TRU and TRU gen set operators that operate in California
    - ✦ Company contact information
    - ✦ Terminals owned or leased in California
    - ✦ TRU & TRU gen set inventory
      - TRU and engine make, model year, serial number
      - Terminal assigned to
      - Identification numbers (e.g VIN, license plate, etc.)

39

## Facility Applicability

- Applies to all facilities in California
  - ◆ A. Frequented by TRUs and TRU gen sets;
  - ◆ B. Under facility control;
  - ◆ C. Where perishable goods are loaded
  - ◆ Of those that qualify under A, B, and C, then
    - ✦ Facilities with  $\geq 20$  loading dock doors or  $\geq 20$  employees,  
or
    - ✦ Facilities whose parent company has more than one qualifying facility in California

40



## Facility Requirements

### ■ Recordkeeping and reporting

#### ◆ Report to ARB by January 1, 2005

- ✦ Contact information
- ✦ Type of facility
- ✦ Number of loading dock doors - refrigerated
- ✦ Square feet of refrigerated storage space
- ✦ Number full time equivalent employees
- ✦ Number of TRUs/TRU gen sets under facility control

42

## Facilities (cont'd)

### ■ Recordkeeping and reporting (cont'd)

- ◆ Number of leased/rented
  - ✦ Trucks and trailers with TRUs
  - ✦ TRU gen sets
  - ✦ Reefer containers
  - ✦ Reefer railcars
- ◆ Total annual TRU/TRU gen set operating hours (units under facility control)

43

## Facilities (cont'd)

### ■ Recordkeeping and reporting (cont'd)

- ◆ Average weekly number of inbound loads
- ◆ Average weekly number of outbound loads
- ◆ Average weekly hours of operation for outbound TRUs/TRU gen sets at facility
- ◆ Estimate of average weekly hours of operation for inbound TRUs/TRU gen sets at facility

44

## Fuel Requirements

- Beginning September 1, 2006
  - ◆ All sales, offers, or supplies of fuel for TRUs/TRU gen sets shall be fuel that is lawful as vehicular fuel (CARB diesel)
- Operators opting to use alternative diesel fuel to comply with in-use reqmts
  - ◆ Recordkeeping to show exclusive use of alternative-diesel fuel
- Fuel tank labeling required

45

## Requirements for Low Use TRUs

- Equip engine with non-resettable hour meter
- Annually certify to ARB by January 31st
  - ◆ TRU and engine serial numbers
  - ◆ Hour meter readings on December 31st
  - ◆ <80 hours operation in last calendar year, and
  - ◆ <10 loads hauled in California in last calendar year
- ARB certificate kept inside TRU chassis housing

46

# Summary

- Requirements for
  - ◆ In-Use TRUs and TRU Gen Sets
  - ◆ Facilities - recordkeeping and reporting
  - ◆ Fuels - vehicular diesel fuel
  - ◆ “Low Use” TRUs

47

# Regulatory Development Schedule

- Next TRU Workgroup meeting, Late July to early August, 2003.
- Next Public Workshop: September 11, 2003
- Board Hearing: October 2003

48

## Contacts

- Tony Andreoni, Manager, PES  
(916) 324-6021 ([tandreon@arb.ca.gov](mailto:tandreon@arb.ca.gov))
- Rod Hill, Air Resources Engineer  
(916) 323-0440 ([rhill@arb.ca.gov](mailto:rhill@arb.ca.gov))
- Fax: (916) 327-6251
- <http://www.arb.ca.gov/diesel/tru.htm>
- <http://www.arb.ca.gov/diesel/dieselrrp.htm>

49